Claims

We claim:

1. An isolated polynucleotide comprising a sequence selected from the group consisting of: SEQ ID NO: 1-12 and 25.

2. An isolated polynucleotide comprising a sequence selected from the group consisting of:

(a) complements of SEQ ID NO: 1-12 and 25;

(b) reverse complements of SEQ ID NO: 1-12 and 25;

(c) reverse sequences of SEQ ID NO: 1-12 and 25;

(d) sequences that are 100-mers of a sequence of SEQ ID NO: 1-12 and 25;

(e) sequences that are 40-mers of a sequence of SEQ ID NO: 1-12 and 25; and

(f) sequences that are 20-mers of a sequence of SEQ ID NO: 1-12 and 25.

3. An isolated polynucleotide comprising a sequence selected from the group consisting of:

(a) sequences having at least 75% identity to a sequence of SEQ ID NO: 1-12 and 25;

(b) sequences having at least 90% identity to a sequence of SEQ ID NO: 1-12 and 25;

(c) sequences having at least 95% identity to a sequence of SEQ ID NO: 1-12 and 25;

(d) sequences having at least 98% identity to a sequence of SEQ ID NO: 1-12 and 25; and

(e) sequences that hybridize to a sequence of SEQ ID NO: 1-12 and 25 under stringent hybridization conditions,

wherein the polynucleotide encodes a polypeptide having substantially the same functional properties as a polypeptide encoded by SEQ ID NO: 1-12 or 25.

4. An isolated oligonucleotide probe or primer comprising at least 10 contiguous residues complementary to 10 contiguous residues of a nucleotide sequence recited in claim 1.

5. A kit comprising a plurality of oligonucleotide probes or primers of claim 4.

6. An isolated polypeptide encoded by a polynucleotide of claim 1.

7. An isolated polypeptide comprising an amino acid sequence selected from the group consisting of: sequences recited in SEQ ID NO: 13-24 and 26.

8. The isolated polypeptide of claim 7, wherein the polypeptide is in multimeric form.

9. An isolated polypeptide comprising an amino acid sequence selected from the group consisting of:

(a) sequences having at least 75% identity to a sequence of SEQ ID NO: 13-24 and 26;

(b) sequences having at least 90% identity to a sequence of SEQ ID NO: 13-24 and 26;

(c) sequences having at least 95% identity to a sequence of SEQ ID NO: 13-24 and 26;

(d) sequences having at least 98% identity to a sequence of SEQ ID NO: 13-24; and

(e) functional portions of a sequence of SEQ ID NO: 13-24 and 26,

wherein the polypeptide possesses an ability to bind ice crystals.

10. An isolated polynucleotide that encodes a polypeptide of any one of claims 7-9.

11. A genetic construct comprising a polynucleotide of any one of claims 1-3.

12. A transgenic cell comprising a genetic construct according to claim 11.

13. A genetic construct comprising, in the 5'-3' direction:

(a) a gene promoter sequence;

(b) a polynucleotide sequence comprising at least one of the following: (1) a polynucleotide coding for at least a functional portion of a polypeptide encoded by a polynucleotide of any one of claims 1-3; and (2) a polynucleotide comprising a non-coding region of a polynucleotide of any one of claims 1-3; and

(c) a gene termination sequence.

14. The genetic construct of claim 13 wherein the polynucleotide is in a sense orientation.

15. The genetic construct of claim 13 wherein the polynucleotide is in an anti-sense orientation.

16. A transgenic cell comprising a genetic construct of claim 13.

17. An organism comprising a transgenic cell according to claim 16, or progeny thereof.

18. A method for modulating cold tolerance in an organism, comprising stably incorporating into the genome of the organism at least one polynucleotide of any one of claims 1-3.

19. The method of claim 18, wherein the organism is selected from the group consisting of: plants; mammals; insects; fungi; archaea; and bacteria.

20. The method of claim 18, comprising stably incorporating into the genome of the organism a genetic construct of claim 13.

21. A method for producing a plant having altered cold tolerance, comprising:

(a) transforming a plant cell with a genetic construct of claim 13 to provide a transgenic cell; and

(b) cultivating the transgenic cell under conditions conducive to regeneration and mature plant growth.

22. The method of claim 21 wherein the plant is selected from the group consisting of: *Lolium* species: *Festuca* species; and *Eucalyptus* species.

23. A method for modifying the activity of an antifreeze protein in an organism comprising stably incorporating into the genome of the organism a genetic construct of claim 13.

24. A method for modifying the activity of an antifreeze protein in an organism, comprising introducing into cells of the organism double stranded RNA corresponding to a polynucleotide of any one of claims 1-3, thereby inhibiting expression of a polypeptide encoded by the polynucleotide.

25. A method for cryopreserving a cell or tissue, comprising contacting the cell or tissue with at least one polypeptide of any one of claims 7-9.

26. A food additive comprising a polypeptide of any one of claims 7-9.

27. A frozen food product comprising a food additive of claim 25.

28. A method for decreasing an amount of time required to dehydrate a composition comprising contacting the composition with a polypeptide of any one of claims 7-9.

29. A composition comprising a polypeptide of any one of claims 7-9 and a physiologically acceptable carrier.

30. A method for the treatment of a disorder characterized by the presence of unwanted biocrystals in a patient, comprising administering to the patient a composition of claim 29.

31. A method for preserving the viability of a molecular biology reagent, comprising contacting the reagent with a polypeptide of any one of claims 7-9.

32. A method for destroying unwanted tissue in a patient, comprising:

(a) perfusing the tissue with a solution comprising a polypeptide of any one of claims 7-9; and

(b) freezing the tissue for a period of time sufficient to mortally damage cells within the tissue.

33. The method of claim 32, wherein the undesirable tissue is tumor tissue.

34. A composition comprising at least one polypeptide of any one of claims 7-9 and an agricultural carrier.

35. A method for protecting a plant from damage due to frost or freezing, comprising applying a composition of claim 34 to the plant.